# EXHIBIT A

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April 21, 2014

Mr. Peter Norris
17111 161st Avenue NE
Woodinville, WA 98072

Geotechnical Engineering Evaluation
**Norris Residence Washout Stabilization**
**25408 Riata Street**
**Chelan County, Washington**
NGA File No. 888013

Dear Mr. Norris,

This letter summarizes the results of our geotechnical engineering evaluation and stabilization recommendations for the erosion event that took place late last year at your residence located at 25408 Riata Street in the Plain area of Chelan County, Washington, as shown on the Vicinity Map in Figure 1. Our services were completed in general accordance with our services agreement signed by you on December 24, 2013.

## INTRODUCTION

We have already worked with your structural engineer and contractors on implementing emergency stabilization measures to stabilize the residence through the winter. The purpose of this study letter is to provide recommendations for permanently stabilizing the residence and restore the area that was affected by the washout.

A waterline broke to the northeast of the residence allowing a significant amount of water to flow around the eastern and southeastern portion of the residence, causing significant amounts of erosion along the eastern and southeastern portion of the residence and steep slope to the south of the residence. This

erosion led to portions of the residence foundation to become undermined and destroyed the deck along the southern and eastern portions of the residence.

We initially visited the site on December 18 and 26, 2013 to observe the existing site conditions. Due to prevailing conditions at that time, we recommended that the undermined portions of the residence be promptly underpinned, on at least a temporary emergency basis, to allow time to further explore permanent stabilization alternatives for the residence and steep slope. We have since observed the implementation of the emergency stabilization work for the residence. This included the installation of 18, 2-inch diameter pin piles to support the undermined portions of the foundation along the southern and eastern portion of the residence. This work was performed based on recommendations that we provided to the contractor and CG Engineering, the structural engineer. We were provided with a preliminary plan set for the emergency underpinning of the residence prepared by CG Engineering, showing the proposed locations and layout of the pin piles. We have provided daily field reports documenting our observations during the emergency underpinning repairs.

## SCOPE

The purpose of this study is to explore and characterize the site subsurface conditions, and provide recommendations for stabilizing the residence and slope areas. Specifically, our scope of services include the following:

**Phase 1: Consultation and Emergency Stabilization Phase (Completed)**

1. Review geologic maps of the area and our previous report done for the property.
2. Map the extent of the failure on the property.
3. Perform shallow hand auger explorations within the site and slope.
4. Consult with your contractor and structural engineers and discuss potential remedy plans for stabilizing the hillside and protecting the residence.
5. Work with your structural engineer and your underpinning contractor to provide emergency stabilization plans for the residence.
6. Provide a letter summarizing our recommendations for emergency underpinning of the residence.
7. Visit the site on a part-time basis to observe the repairs.
8. Document our observations and recommendations during the repairs in written field reports.

**Phase 2: Long-term Site Stabilization Phase (Current phase)**

1. Work with your civil/structural engineer and other consultants/contractors to provide long-term stabilization plans for the residence and property.
2. Determine the most feasible and practical solution for residence and slope stabilization and finalize the plans. Plans could include retaining structures and tie bodies, additional deep foundation systems, drainage improvements, and erosion control systems.
3. Provide recommendations for long-term slope maintenance and monitoring.
4. Document our findings, conclusions, and recommendations in a written letter report.
5. Work with other consultants to obtain permits for implementing the work, as needed.
6. Monitor the implementations of the permanent repairs.
7. Provide field reports of our observations during the implementation of the repairs.
8. Provide a final summary letter at the end of the project.
9. Provide additional geotechnical consultation services for the project, as requested by you or your representatives.

## SITE CONDITIONS

### Surface Conditions

The site consists of an irregular-shaped parcel covering approximately 0.48 acres. The site is occupied by a two-story, single-family residence with a daylight basement within a relatively level to gentle south sloping bench area within the central portion of the site. A moderate to steep south-facing slope descends from the southern side of the residence down to the Wenatchee river at a gradient of approximately 34 degrees (66 Percent) as shown on Cross Section A-A' in Figure 3. The overall height of the slope below the residence is approximately 100 feet. The slope is generally vegetated with underbrush and mature evergreen trees. The site layout within the vicinity of the residence is shown on the Schematic Site Plan in Figure 2.

The observed erosion appeared to have started along the eastern side of the residence and extended around the southeastern side of the residence. The erosion then continued down the slope to the south and deposited material along the Wenatchee River. The washout observed within the upper portion of the slope near the residence was up to 25 feet wide and up to 20 feet deep. The washout undermined the southeastern corner of the residence foundation and basement slab-on-grade. The washout also completely destroyed the deck and concrete patio along the southern and eastern portions of the residence. We did not observe significant signs of distress within the residence itself during our site visits and the undermined portions of the residence foundation have since been underpinned. We did not observe

surface or seeping water in the immediate vicinity of the residence or on the slope during our site visits, but we did observe some perched water seepage on the lower portion of the slope of the property to the east.

### Subsurface Conditions

**Geology:** The geologic units for this area are mapped on the Geologic Map of the Chelan 30-Minute Quadrangle, Central Washington, by R. W. Tabor, et.al., (USGS, 1987). The project site is mapped as being within sediments described as Terrace Gravel (Pleistocene) (Qtg). These deposits are understood to consist of moderately sorted cobble to pebble gravel, derived from late stage glacial recession and terrace deposition. Soils exposed in the washout area within the slope appear to consist of sand and gravel soils consistent with the description of Terrace Gravel deposits. Bedrock, consisting of the Chumstick Formation (Tc), was observed within the lower portion of the slope and toe of slope area. The Chumstick formation materials consist of Eocene age sandstone, shale and conglomerate. Based on the driving records of the pin piles, it appears that the bedrock is at least 60 feet deep at the location of the residence.

### Hydrologic Conditions

We did not observe any groundwater seepage within the washout area during our site visits. However, we anticipate that a perched water condition could likely occur within the onsite soils. Perched water occurs when surface water infiltrates through less dense, more permeable soils and accumulates on top of underlying, less permeable soils. Perched water does not represent a regional groundwater "table" within the upper soil horizons. Perched water tends to vary spatially and is dependent upon the amount of precipitation. We would expect the amount of perched water to decrease during drier times of the year and increase during wetter periods.

## SENSITIVE AREA EVALUATION

### Seismic Hazard

We reviewed the 2012 International Building Code (IBC). Since mostly competent granular soils are interpreted to underlie the site at depth, the site conditions best fit the IBC description for Soil Class D for native soils.

Hazards associated with seismic activity include liquefaction potential and amplification of ground motion. Liquefaction is caused by a rise in pore pressures in a loose, fine sand deposit beneath the

groundwater table. It is our opinion that the competent native soils interpreted to underlie the site have a low potential for liquefaction or amplification of ground motion.

The competent granular soils interpreted to form the core of the site slope are considered stable with respect to deep-seated slope failures. However, the loose surficial materials on the steep slope have the potential for failures during strong seismic events. Such events should not directly affect the residence provided the recommended repairs to the residence are designed and implemented as described in this letter.

### Landslide Hazard/Slope Stability

The criteria used for evaluation of landslide hazards include soil type, slope gradient, and groundwater conditions. A steep south-facing slope with a gradient of up to approximately 34 degrees (66 percent) with a height of approximately 100 feet is located below the existing residence.

Our observations indicate that the core of the steep slope consists primarily of competent granular soils. Inclinations in the range of 34 degrees on the slope indicate high strength and internal friction angle within the underlying soils. It is our opinion that the core of the slope is stable and that the recommended pin piles and anchors should terminate in stable soils. It is also our opinion that there is a significant potential for on-going failures within the loose surficial soils on the steep slope and the erosion area if these soils are not stabilized. Proper site grading and drainage as well as stabilization techniques as recommended in this letter should help improve current stability conditions.

## CONCLUSIONS AND RECOMMENDATIONS

### General

Based on our observations, it is our opinion that the recent washout appears to be directly related to the water leakage from the broken water line along the northeast corner of the residence. It is our understanding that the broken water line may have leaked for up to two days prior to being shut off. The water from the broken line likely saturated the soils within the vicinity of the residence leading to the subsequent loss of their shear strength causing the failure. Flow from the broken water line likely continued after the initial soil failure leading to additional erosion and undermining of the residence foundations.

As a part of the emergency stabilization repairs for the residence, we have observed the installation of 18, 2-inch diameter steel pin piles along the southern and eastern foundation lines of the residence. Although, it is our opinion that the erosion only affected soils within the erosion area rather than the core of the slope, it is likely that erosion and sloughing episodes and slope movement will continue and will eventually impact the residence and the pin piles if adequate permanent measures for stabilizing the affected areas are not implemented.

In addition to the above emergency stabilization measures, we recommend that the undermined portion of the residence foundation be extended down to the existing ground surface below with a new shotcrete retaining wall supported on the previously installed pin piles, and helical anchor tiebacks to anchor the new foundation wall into the core of the slope. We also recommend that the undermined area below the slab-on-grade be backfilled with geofoam blocks and pressurized grout to fill any remaining voids within this area. Detailed recommendations regarding the proposed residence foundation repairs have been included in the **Residence Foundation Improvements** subsection of this letter.

After the stabilization measures for the residence have been completed, restoring the washout area around and below the residence should consist of removing the loose soils, debris and vegetation from the erosion area and backfilling the depression with heavy crushed rock. A quarry rock buttress should be constructed within the upper portion of the slope where the erosion area narrows. The remaining portion of the erosion area should then be completely backfilled with 4- to 8-inch quarry spalls to the existing ground surface outside the erosion area. If desired, the quarry rock could then be covered with topsoil, heavy-duty erosion control matting, and deep-rooting vegetation. Detailed recommendations for the erosion area stabilization measures are described in the **Erosion Area Stabilization and Drainage** subsection of this letter. The approximate extents of the proposed residence and erosion area stabilization measures are shown on the Schematic Repair Section Detail in Figure 4.

## Residence Foundation Improvements

**General:** We recommend that the undermined portion of the residence foundation be extended down with a new shotcrete retaining wall supported directly on the previously installed pin piles. The new foundation wall should be embedded a minimum of two feet below current grade and should be structurally tied to the installed pin piles. We recommend that the lateral loads on the new shotcrete retaining wall be transferred to helical anchor tiebacks installed along the face of the wall as described below. We should be retained to review final plans, and monitor installation of the anchors.